**VCE Physics**

**Some Possible Practical Activities for the Practical Activities Fair on Friday, 12th April at Kew HS**

**Unit 1 How are light and heat explained?**

**Electromagnetic radiation**

| | Practical Activity | Description | Type | Equipment |
|---|---|---|---|---|
| 1 | Introductory activity | A series of short exercises on the properties of light which can be used to generate a set of questions. See vicphysics.org for activities and questions. e.g. Line up four pins through glass block, use a Fresnel lens, bifocals with three rays from light box, apparent depth with glass block, combine colours from three light boxes | Observation exercise | Fresnel lens, glass block with four large pins and pin board bifocals, apparent depth, three light boxes with coloured filters |
| 2 | Types of waves | Use a slinky to demonstrate transverse waves.<br>Use a ripple tank to demonstrate wave properties | Demonstrations | Slinky<br>Ripple Tank |
| 3 | Refraction of Light: | Use semicircular plastic dish and glass or perspex rectangular blocks to investigate Snell's law. | Experiment | Plastic dish for water, or Perspex block, laser pointer or pins on cork board |
| | | Apparent depth: Look down a glass block at a piece of graph paper under it. Move another piece up the side until the grids match. | | Glass block, graph paper |
| | Total Internal Reflection | Show total internal reflection. | Demonstrations | Glass prisms, light box, laser pointer |
| | | Show TIR in optical fibres and light pipes. Combine 3 and 4, 6 | | |
| | Mirage | Sugar Solution with varying density | Demonstration | Sugar solution prepared day before |
| 4 | Dispersion of Light | Show the colour components of white light. | Demonstration | Glass prism, light box |
| 5 | EM Spectrum | Spectra from an incandescent light globe as the voltage increases Check Penny Hale for Prac with Tracker | Class exercise | Spectrometer, low voltage light globe |

**Thermal Energy**

| | Practical Activity | Description | Type | Equipment |
|---|---|---|---|---|
| 1 | Phenomena | Introductory practical activity on heating and cooling phenomena to stimulate curiosity and generate context questions for later assessment, for example: i) Dab metho on wrist, ii) Wet thermometer in front of fan, iii) See 'vicphysics.org'<br>Check Halid's heat stations, ice cube in water and in salt water | Introductory | Infra red source, thermometers, metho, fan, thermal conductivity kits, bunsen burners |
| 2 | Heat Capacity | i) Mixing liquids heated to different temperatures, ii) Adding a heated block to water, iii) Determine the heat capacity of thermos, iv) Use a microwave oven to estimate heat capacity | Experiments | Beakers, metal blocks, ice blocks, bunsen burners, thermometers |
| 3 | Latent Heats | i) Add ice to hot water, ii) Use a microwave oven to estimate latent heat | Experiments | Beakers, ice blocks |
| 4 | Energy transfer mechanisms | Keeping it Hot – design, build & test a thermos for a plastic cup of hot water from Reverse Art Truck materials.<br>Comparison of conduction, convection and radiation? | Investigation | Cup, waste fabric, foam, alfoil, tape, thermometer |

**Unit 1 How is energy from the nucleus utilised?**

| | Practical Activity | Description | Type | Equipment |
|---|---|---|---|---|
| 1 | Properties of radiation | Show the range of alpha, beta and gamma radiation | Demonstration | Sources, Geiger counter, lead filters |
| ~~2~~ | Half life | Simulation with dice | Experiment | Box of 50 dice |
| 3 | Half life | Measurement of a short lived radioisotope, e.g Protactinium, Caesium 137 | Class exercise / experiment | Half-life source, Geiger counter |

**Unit 1 How can electricity be used to transfer energy?**

| | Practical Activity | Description | Type | Equipment |
|---|---|---|---|---|
| 1 | Potential difference | Measure and graph voltage drops around a simple circuit of a battery and two resistors across connecting wires, resistors and the battery | Experiment | Voltmeters, ammeters, resistors,batteries |
| 2 | Ohm's Law | Measure and graph the voltage across the and current through a resistor | Experiment | See above |
| 3 | Resistors in series | Measure and graph the voltages across each of two resistor in series, as well as the voltage across the combination for various current values | Experiment | See above |
| 4 | Resistors in parallel | Measure and graph currents through each of two resistor in parallel, as well as the current through the combination for various voltage values | Experiment | See above |
| 5 | Non-ohmic resistor | Measure and graph the voltage across and the current through a 12 V light globe as the voltage is increased. | Experiment | Light globe |
| 6 | Diode | Measure and graph the voltage across and the current through a diode or other non-ohmic components as the voltage is increased in both orientations | Experiment | Diode |
| 7 | LDR, Thermistor | Measure and graph the voltage across and the current through an LDR or a thermistor as the voltage is increased. **Set up** | Experiment | Semiconductors |
| 8 | Voltage divider | Measure output voltage as thermistor is heated. **Set up** | Experiment | See above |
| 9 | Household wiring | Investigate a 'Wiring in a House Demonstration Board' | Experiment | |
| 10 | Photovoltaic panel | Measure the voltage output and current from a PV panel under a variety of resistive load and light conditions. | Experiment | PV panel |
| 11 | Dissection of an electrical device | Dissect an electrical appliance such as a heater, dryer, iron, etc Note: the power cord should be cut. | Exercise | Old hair dryer, etc |

**Unit 2 How can motion be described and explained?**

| | Practical Activity | Description | Type | Equipment |
|---|---|---|---|---|
| 1 | Accelerated motion | Record position vs time of a trolley on a low friction track on an incline and generate displacement and velocity vs time graphs | Experiment | Low friction track, air track or trolleys |
| 2 | Complex motions | Use a motion detector to describe actions such as walking.<br>Use video analysis to investigate movement in athletics. | Class exercise<br>Experiment | Motion detector,<br>Video with tracker |
| 3 | Motion under gravity | Drop a quadratic string, a string with pendulum bobs at distances so that they hit the ground at equal time intervals.<br>Drop 0.5kg and 5kg masses at same time on to foam.<br>Use ultrasound motion detector to display the motion of a bouncing basketball. | Demonstrations | |
| 4 | Normal Force | Use bathroom scales to investigate the normal force when standing, leaning or in a lift. | Class exercise | Scales or force plate |
| 5 | Friction | Static vs sliding friction. Use a spring balance to get a block to move and then keep moving. Place a block on an inclined plane and increase angle until it moves. | Experiment | Blocks, spring balance, string |
| 5 | Combining forces | Use a Forces table to show vector addition of forces and also components of forces<br>Use a Newton's cart on front bench to show force components. | Class exercise<br>Demonstration | Force table<br>Newton's cart |
| 6 | Newton's 2nd law | Record position vs time of a glider on a level air track or a trolley accelerated by a falling mass. Investigate acceleration for a range of values of falling masses and total mass moved.<br>Use a Newton's cart on front bench to investigate how acceleration depends on mass for a constant force. | Experiment<br><br>Demonstration | Air track gliders or trolleys<br><br>Newton's cart |
| 7 | Hooke's Law | Measure, graph and analyse the extension of a spring produced by various masses. | Experiment | Springs, masses |
| 8 | Energy transfer and transformations | Measure drop and rebound height of a rubber ball. (GPE, efficiency, KE)<br>Time 10 lifts of a 2.0 kg mass from shoulder level (GPE, Power)<br>Time the run up a flight of stairs (GPE, Power)<br>Measure time and distance of a loaded trolley rolling down a slope (GPE, KE)<br>Time the drop of balls of different densities from roof height (GPE, KE, air resistance)* These can be done as a round robin of short activities | Experiment | Rubber ball,<br>2.0 kg mass |
| 9 | Momentum in collisions | Measure speeds of air track gliders or dynamics trolleys before and after impact to investigate conservation of momentum.<br>Newton's Cradle | Class exercise<br><br>Demonstration | Air track gliders or trolleys<br>Cradle |

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| | | Measure impulse | | Force meter |

**Unit 3: How fast can things go? Motion in one and two dimensions**

| | Practical Activity | Description | Type | Equipment |
|---|---|---|---|---|
| 1 | Circular motion | Investigate how the centripetal acceleration of a revolving rubber stopper, as measured by the number of washers on the end of the line, is affected by changes in radius and frequency.<br>Investigate how the centripetal acceleration of a passenger in a Luna Park ride is related to the dimensions and speed of the ride. | Experiment<br><br>Excursion | Circular motion kit |
| 2 | Projectile motion | Use ballistics car to demonstrate components.<br>Investigate range, maximum height and time of flight for a range of angles and initial speed | Demonstration<br>Experiment | Ballistics car |
| 3 | Changes in Potential energy | Use a dropped mass attached to a spring to investigate the transformation of energy between gravitational potential energy, spring potential energy and kinetic energy.<br>Investigate the energy transformation in a Luna Park ride. | Experiment<br><br>Excursion | Springs, masses |
| 4 | Momentum and kinetic energy in collisions | Measure speeds of air track gliders before and after impact to investigate conservation of momentum and the elasticity of the collision.<br>Newton's Cradle | Class exercise<br><br>Demonstration | Air track gliders or trolleys |
| 5 | Normal force | Use bathroom scales to investigate the reaction force when standing, leaning against a wall or in a lift.<br>Investigate how the centripetal acceleration of a passenger in a Luna Park ride and determine the value of the normal force. | Class exercise<br><br>Excursion | Bathroom scales |

**Unit 3: How do things move without contact?**

| | Prac Activity | Description | Type | Equipment |
|---|---|---|---|---|
| 1 | Coulomb's Law | Dependence of electric force on charge and separation using a top loading balance | Experiment | Top loading balance, charged rod and sheet of Alfoil |
| 2 | Electric Field | Plotting of electric field of various configurations of point charges | Experiment | |
| 3 | Properties of magnets | Investigate Force between magnets<br>Investigate magnetic field of bar and horseshoe magnets | Demonstration or Class Exercise | Top loading balance, magnets, ceramic plate |
| 4 | Oersted's Expt | Show magnetic effect of an electric current in magnetic field | Demonstration | Oersted apparatus |
| 5 | Right Hand Slap Rule | Show magnetic force on current loop<br><br>Show movement of Al rod on rails with horseshoe magnet<br>Show slow oscillation of loudspeaker cone | Demonstration<br><br>Demonstration<br>Demonstration | <br><br>Large loudspeaker |
| 6 | Magnetic field of current carrying wire | Investigate magnetic field around a current carrying wire | Experiment | Constant current supply, compasses, wire rated for up to 5A |
| 7 | Magnetic field of Solenoid | Use current balance kit to determine magnetic field of a solenoid | Experiment | Current balance kit |
| 8 | Turning Effect in a meter | Investigate meter mechanism with small compass | Class Exercise | Demonstration meter, compass |
| 9 | Model DC Motor | Show motor principle with models | Demonstration | |
| 10 | Dissection of DC Motor | Dissect a small DC motor then reassemble | Class Exercise | Old ripple tank motor |

**Unit 3: How are fields used in electricity generation?**

| | Practical Activity | Description | Type | Equipment |
|---|---|---|---|---|
| 1 | Electromagnetic Induction | Show generation of induced EMF by magnet in solenoid | Demonstration | Bar magnet, solenoid, demonstration galvanometer or voltage probe |
| 2 | Model Generator | Use a model generator to demonstrate production of AC and DC. | Demonstration | Model generator |
| 3 | Electromagnetic Induction | Investigate Lenz' Law | Formal Experiment | Solenoids, wires, galvanometer, power supply, magnet |
| 4 | Electromagnetic Induction | Drop strong magnet through an Al cylinder | Demonstration | Al cylinder, ceramic magnet |
| 5 | Transformer | Show effect of Turns ratio on voltage and current | Demonstration | Demountable transformer |
| 6 | Transmission Lines | Show the effect of transformers on Power loss and voltage drop | Demonstration | T’n line model |

**Unit 4 How has understanding about the physical world changed?**

| | Practical Activity | Description | Type | Equipment |
|---|---|---|---|---|
| 1 | Interference | Use a sound source connected to two speakers to produce an interference pattern in front of the speakers. Note nodal positions and measure distances to determine wavelength. Change spacing of speakers and change of nodal positions | Experiment | Freq generator, two speakers |
| 2 | Reflection of waves | Use a slinky to show reflection of transverse pulses at fixed and free ends. | Demonstration | Slinky |
| 3 | Superposition of waves | Use a slinky to show the superposition of transverse pulses. | Demonstration | Slinky |
| 4 | Standing waves in strings | Attach a weighted string to a ticker timer | Demonstration / experiment | Standing wave apparatus |
| 5 | Diffraction of waves | Use a sound source at different frequencies and with speakers of different diameters to observe the amount of spreading.<br>Use of a ripple tank to show diffraction | Demonstration | Sound source, speaker, barrier |
| 6 | Diffraction of light | Investigate diffraction of light through red and blue filters with slides of single slit of varying widths | Class Exercise or Experiment | Diffraction and Interference Kit |
| 7 | Interference of light | Investigate interference of light through red and blue filters with slides of double slits of varying size | Class Exercise or Experiment | Diffraction and Interference Kit |
| 8 | Photoelectric Effect | Discharge of electroscope with zinc plate on top with UV light | Demonstration | |
| 9 | Photoelectric Effect | Investigate the effect of intensity and frequency of light incident on a metal surface on the energy of ejected electrons | Class Exercise | PE Effect apparatus |
| 10 | Hydrogen Spectrum | Investigate the energy levels of Hydrogen | Class Exercise | Spcctral lamps, spectroscopes |
| 11 | Energy gap in LEDs | Investigate the triggering voltage for LEDs producing light of different wavelengths | Experiment | LEDs of different colours, circuit |